

## Appendix A

### Second-Year Data Collection and Response Rates

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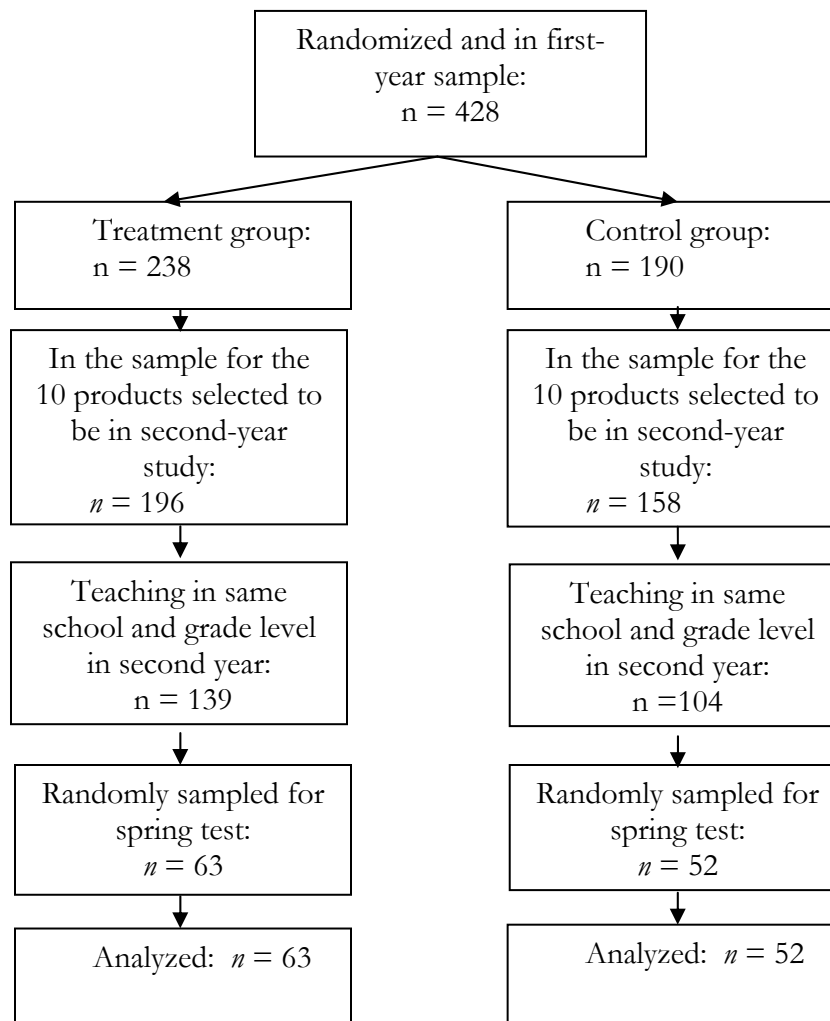
This appendix describes the study's data collection approach in the second year and provides more detail about response rates.

The study's data collection is based on the framework established in the study's first year. During this time, teachers who volunteered to participate in the study were randomly assigned to treatment or control groups. However, not all teachers who had participated in the first year were part of the second year study, due to attrition and mobility. Moreover, products that had been implemented only in a few schools and for which detecting a product effect was unlikely because of low statistical power were not included in the second year. The study team also added some schools and teachers to increase sample sizes for some products that were on the margin of adequate statistical power. Teachers new to the study were randomly assigned to the treatment or control groups as was done in the first year.

To reduce costs, the study tested fewer classrooms in spring 2006 than in fall 2005. Schools that had one treatment and one control teacher were tested. For schools that had more than one treatment or control teacher, one treatment teacher and one control teacher were randomly sampled from the groups. For example, if a school had three treatment and two control teachers, one of the three treatment teachers was sampled and one of the two control teachers was sampled. The sampling probability was set such that one teacher was sampled from the treatment or control groups. For example, if three teachers were in the treatment group, the sampling probability for a treatment teacher was 33 percent. An additional cost modification in the second year was that for some districts that administered their own nationally normed test, the study collected scores for that test from district records rather than conduct its own test.

#### A. Teacher Samples

Chapter II examined product effects after teachers had a year of experience using products. Figure A.1 shows the components of the teacher sample that were used in that analysis.

**Figure A.1. Teacher Sample for Experience Effects (Chapter II)**

Three aspects of the design determined the teacher sample for the analysis in Chapter II. First, of the 428 teachers in the first year of the study, selecting the 10 products for the second year left 354 teachers. Of that number, mobility to other schools and grade levels left 243 teachers. Randomly sampling teachers left 63 treatment group teachers and 52 control group teachers, which is the analysis sample used to study the effects of a second year of teaching experience using software products on student test scores presented in Chapter II. For the sample of teachers used for the analysis of individual products presented in Chapter III, see Appendix B.

For the study of individual product effects in Chapter III, the flow of teachers consists of teachers who were in the sample only the first year, only in the second year, and in both years. Figure A.2 shows the treatment and control group samples for the three components of the teacher sample. The largest of the three components, almost 60 percent of the total, is the sample of teachers who were only in the first year.

**Figure A.2. Teacher Sample for Individual Product Effects (Chapter III)**

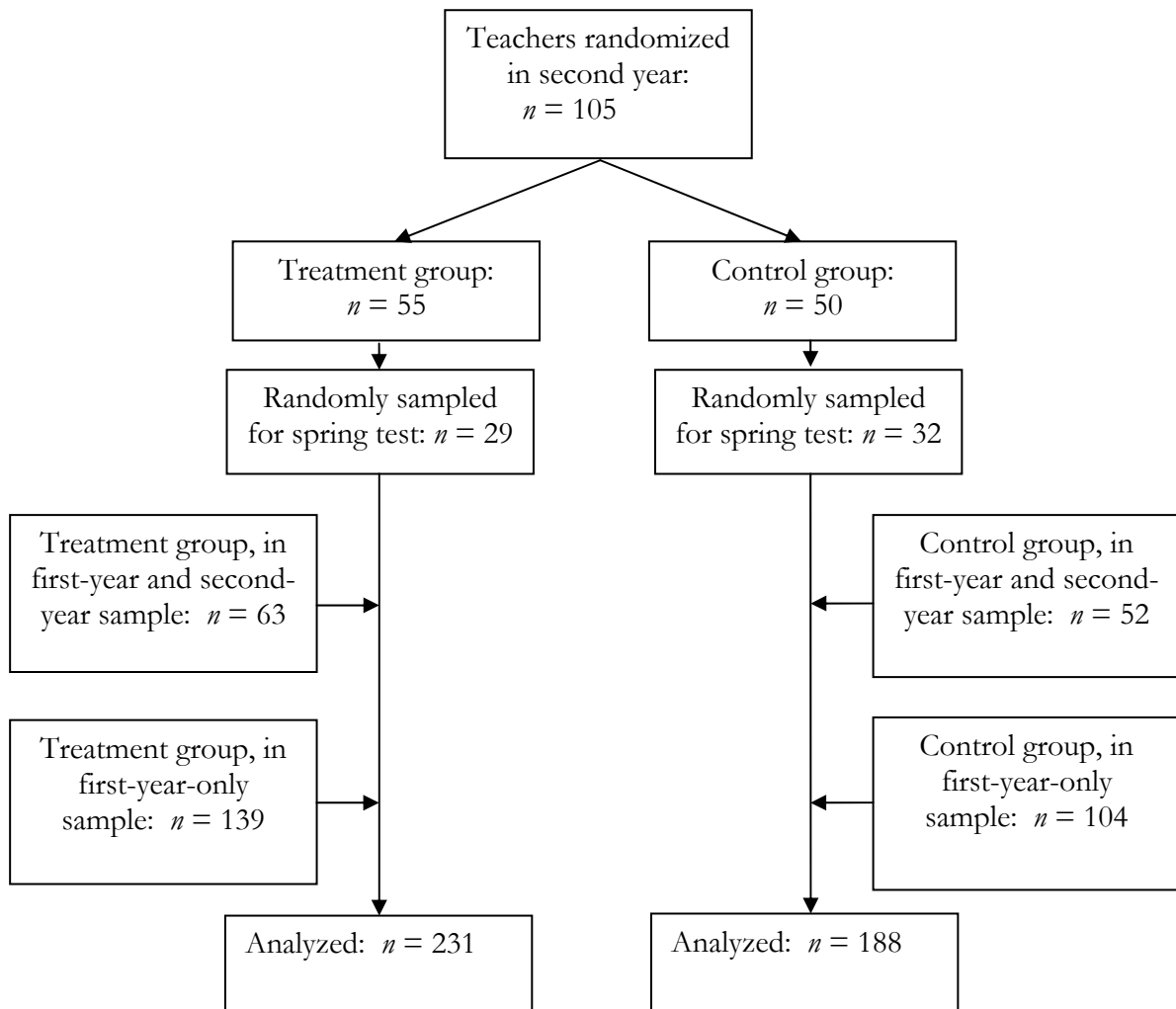


Table A.1 shows the breakdown of teachers in the second year by product and by whether the teachers also were included in the first year.

## B. Teacher Survey

In November 2005, teacher questionnaires were mailed to schools for those teachers new to the study in the second year and teachers who had not completed a questionnaire in the first year. Ultimately, 97 percent of teachers completed a questionnaire. Completion rates ranged from 91 percent of fourth grade teachers to 100 percent of sixth grade teachers.

**Table A.1. Teacher Sample Sizes, by Product**

	All			Treatment			Control		
	Total	Year 2 and Year 1	Year 2 Only	Total	Year 2 and Year 1	Year 2 Only	Total	Year 2 and Year 1	Year 2 Only
Total	176	115	61	92	63	29	84	52	32
First Grade: Destination Reading	25	8	17	15	5	10	10	3	7
First Grade: Headsprout	18	9	9	9	5	4	9	4	5
First Grade: Plato Focus	18	6	12	9	3	6	9	3	6
First Grade: Waterford Early Reading	20	20	0	11	11	0	9	9	0
Fourth Grade: Academy of Reading	14	5	9	7	3	4	7	2	5
Fourth Grade: LeapTrack	8	8	0	4	4	0	4	4	0
Sixth Grade: Achieve Now	20	18	2	9	8	1	11	10	1
Sixth Grade: Larson Pre-Algebra	18	17	1	10	10	0	8	7	1
Algebra I: Cognitive Tutor	18	12	6	9	8	1	9	4	5
Algebra I: Larson Algebra I	17	12	5	9	6	3	8	6	2

**Table A.2 Teachers Completing the Teacher Survey, Second Year**

	Teachers		
	Total	Number Completing Survey	Percentage
Total	264	255	97
First Grade	112	109	97
Fourth Grade	57	52	91
Sixth Grade	47	47	100
Algebra I	48	47	98

### C. Student Data Collection

The two criteria for testing students in the fall were: (1) parental consent was received, and (2) students did not have barriers to testing (disability or language issues). For the spring test, classrooms randomly selected for testing included students who had been tested in the fall as well as students who had entered study classrooms after the baseline test was administered. To reduce costs, the study team did not test students in districts that could provide nationally normed standardized test score data.

### Student Sample in the Second Year

Table A.3 shows students by classroom assignment status, as well as the breakdown of treatment and control groups by product. The table corresponds to the sample of students who participated in the study in the second year.

**Table A.3. Eligible Student Sample by Assignment and Grade, Second Year**

	Eligible Sample		In Treatment Classrooms		In Control Classrooms	
	Students	Teachers	Students	Teachers	Students	Teachers
Total	3,884	176	2,111	92	1,773	84
<b>First Grade</b>	1,460	81	804	44	656	37
Destination Reading	465	25	277	15	188	10
Headsprout	284	18	150	9	134	9
Plato Focus	329	18	164	9	165	9
Waterford Early Reading Program	382	20	213	11	169	9
<b>Fourth Grade</b>	581	22	305	11	276	11
Academy of Reading	319	14	159	7	160	7
LeapTrack	262	8	146	4	116	4
<b>Sixth Grade</b>	899	38	490	19	409	19
Achieve Now	400	20	186	9	214	11
Larson Pre-Algebra	499	18	304	10	195	8
<b>Algebra I</b>	944	35	512	18	432	17
Cognitive Tutor	381	18	203	9	178	9
Larson Algebra I	563	17	309	9	254	8

## Student Tests

To conserve resources, in the second year the study only administered tests in districts where the district did not administer a standardized normed test as part of their assessments. In districts where standardized tests were available, those scores were used as fall or spring scores by the study team. For first grade, one district provided scores on the Iowa Tests of Basic Skills administered in October of 2005, which were used as fall scores. Another district provided scores on the Stanford Achievement Test, tenth edition, administered in March of 2006, which were used as spring test scores. For fourth grade, one district provided scores on the Iowa Tests of Basic Skills administered in October of 2005 and another provided scores on the California Achievement Test, sixth edition, administered in March of 2005 in the previous grade and school year. Scores from both districts were used as fall test scores. For sixth grade, one district provided scores on the Iowa Tests of Basic Skills administered in October of 2005 and another provided scores on the New Mexico Standards Based Assessment administered in March of 2005 in the previous grade and school year. Scores from both districts were used as fall test scores. Furthermore, one district provided scores on the New Mexico Standards Based Assessment administered in March of 2006, which

**Figure A.3. Achievement Tests Administered by the Study or Provided by Districts**

	<b>Fall 2005 Test</b>	<b>Spring 2006 Test</b>
First Grade	Stanford Early School Achievement Test (SESAT 2, Form S) One district provided Iowa Tests of Basic Skills (ITBS) scores	Stanford Achievement Test, Abbreviated Primary 1, Ninth Edition, Form S (SAT-9) One district provided Stanford Achievement Test, Tenth Edition (SAT-10) scores
Fourth Grade	Stanford Achievement Test Abbreviated Battery Primary 3, Tenth Edition (SAT-10) One district provided Iowa Tests of Basic Skills (ITBS) scores One district provided California Achievement Test, Sixth Edition (CAT/6) scores	Stanford Achievement Test Abbreviated Battery Intermediate 1, Tenth Edition (SAT-10)
Sixth Grade	Stanford Achievement Test Abbreviated Battery Intermediate 2, Tenth Edition (SAT-10) One district provided Iowa Tests of Basic Skills (ITBS) scores One district provided New Mexico Standards Based Assessment (NMSBA) scores	Stanford Achievement Test Abbreviated Battery Intermediate 3, Tenth Edition (SAT-10) One district provided New Mexico Standards Based Assessment (NMSBA) scores
Algebra 1	Educational Testing Service End-of-Course Algebra Test (ETS) One district provided Iowa Tests of Basic Skills (ITBS) scores	Educational Testing Service End-of-Course Algebra Test (ETS)

were used as spring scores. For algebra I, one district provided scores on the Iowa Tests of Basic Skills administered in October of 2005, which were used as fall scores.

The study team administered tests during regular class periods in the fall and spring. Tests were normally administered two to three weeks after the start of the school year and four to six weeks before the end of the school year. In the fall, the testing response rate averaged 88 percent for treatment classrooms and ranged from 75 percent in algebra I to 98 percent in first grade. In the spring, the testing response rate averaged 83 percent for treatment classrooms and ranged from 75 percent in sixth grade to 94 percent in first grade. In the spring, the study tested 1,760 students and districts provided scores for 484 students (see bottom of Table A.4). Figure A.3 lists the tests the study administered and tests that districts provided.

**Table A.4. Number of Students and Percentage Tested in Fall and Spring, 2005-2006 School Year**

	Eligible Students in Treatment Classrooms	Eligible Students in Control Classrooms	Eligible Students in Treatment Classrooms Tested by Study	Eligible Students in Treatment Classrooms Tested by District	Eligible Students in Control Classrooms Tested by Study	Eligible Students in Control Classrooms Tested by District	Response Rate, Treatment Classrooms	Response Rate, Control Classrooms
<i>First Grade</i>								
Fall	804	656	753	38	600	33	98%	96%
Spring	804	656	531	223	461	156	94%	94%
<i>Fourth Grade</i>								
Fall	305	276	145	98	138	104	80%	88%
Spring	305	276	232	0	231	0	76%	84%
<i>Sixth Grade</i>								
Fall	490	409	356	94	245	119	92%	89%
Spring	490	409	325	42	269	63	75%	81%
<i>Algebra I</i>								
Fall	512	432	345	39	302	19	75%	79%
Spring	512	432	407	0	340	0	79%	79%
<i>Total</i>								
Fall	2,111	1,773	1,599	269	1,285	275	88%	88%
Spring	2,111	1,773	1,495	265	1,301	219	83%	88%

Table A.5 presents sample sizes by product. Student attrition rates reported in the table are calculated by dividing students with a spring 2006 test score by the number of eligible students for whom test scores could have been provided. The first grade sample has the lowest attrition rate, at 6.1 percent, and sixth grade had the highest attrition rate, at 22.2 percent.

**Table A.5. Student Attrition Rates in the Second Year**

	All			Students in Treatment Group Classrooms			Students in Control Group Classrooms			Differential Attrition Rate
	N	Percentage of Eligible Students	Attrition Rate	N	Percentage of Eligible Students	Attrition Rate	N	Percentage of Eligible Students	Attrition Rate	
<b>First Grade</b>	1,371	93.9	6.1	754	93.8	6.2	617	94.1	6.0	0.3
Destination Reading	453	97.4	2.6	269	97.1	2.9	184	97.9	2.1	0.8
Headsprout	268	94.4	5.6	145	96.7	3.3	123	91.8	8.2	-4.9
Plato Focus	319	97.0	3.0	159	97.0	3.1	160	97.0	3.0	0.1
Waterford	331	86.7	13.4	181	85.0	15.0	150	88.8	11.2	3.8
<b>Fourth Grade</b>	463	79.7	20.3	232	76.1	23.9	231	83.7	16.3	7.6
Academy of Reading	282	88.4	11.6	136	85.5	14.5	146	91.3	8.8	5.7
LeapTrack	181	69.1	30.9	96	65.8	34.2	85	73.3	26.7	7.5
<b>Sixth Grade</b>	699	77.8	22.2	367	74.9	25.1	332	81.2	18.8	6.3
Achieve Now	313	78.3	21.8	145	78.0	22.0	168	78.5	21.5	0.5
Larson Pre-Algebra	386	77.4	22.6	222	73.0	27.0	164	84.1	15.9	11.1
<b>Algebra I</b>	747	79.1	20.9	407	79.5	20.5	340	78.7	21.3	-0.8
Cognitive Tutor	276	72.4	27.6	145	71.4	28.6	131	73.6	26.4	2.2
Larson Algebra I	471	83.7	16.3	262	84.8	15.2	209	82.3	17.7	-2.5

### Imputing Missing Data

Some students did not take all tests or subtests and some districts did not provide test scores or other data. The largest number of missing tests occurred for the algebra I pre-test. The study imputed about 30 percent of fall 2005 scores. In first grade, approximately 5 percent of test scores were imputed. In fourth and sixth grades, one percent of spring test scores and 3 to 4 percent of fall test scores were imputed. Components of the test scores and student age and gender were imputed using the Markov Chain Monte Carlo (MCMC) method in SAS 9. The imputation was done five times separately for students in treatment and control classrooms. The HLM estimation procedure used by the study used the five imputed data sets and calculated variances of the estimates that incorporated the added variance from the imputation. As noted in the first year report (Dynarski et al. 2007, p. 88), the imputation method was tested in the first year by setting random samples of data to “missing,” and calculating correlations between imputed scores and actual scores. The correlations were high, in the range of 90 percent to 95 percent for different samples, indicating that the MCMC method successfully imputed scores that were close to the actual scores.

## Appendix B

### Description of Sample for the 10 Products

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For the analysis of individual product effects, the study focused on the set of products for which data were collected in the second year of the study. The analysis sample includes all students, teachers, and schools that participated in the study in the first or second year of the study, restricting to those schools that used one of the 10 products for which data were collected in the second year.

The final sample includes 127 schools in 29 school districts that participated in the first or second year of the study and that used any of the 10 products for which data were collected in the second year. The sample includes 419 teachers, 231 assigned to the treatment group and 188 assigned to the control group. Table B.1 shows final counts of teachers in the sample by assignment status, by year of participation, and by product.

Table B.2 shows final counts of students by classroom assignment status, as well as the breakdown of treatment and control groups by product. The table corresponds to the full sample of students used for estimations of individual product effects on test scores.

Tables B.3a-d show means and standard deviations for all data items used in the estimation models. Some data items are defined only for treatment classrooms, and school characteristics are the same for treatment and control classrooms.

Table B.1. Sample of Teachers, by Product

	Number of Teachers Participating											
	All				Treatment				Control			
	Total	Only Year 1	Year 2 and Year 1	Only Year 2	Total	Only Year 1	Year 2 and Year 1	Only Year 2	Total	Only Year 1	Year 2 and Year 1	Only Year 2
Total	419	243	115	61	231	139	63	29	188	104	52	32
First Grade: Destination Reading	35	10	8	17	21	6	5	10	14	4	3	7
First Grade: Headsprout	63	45	9	9	32	23	5	4	31	22	4	5
First Grade: Plato Focus	29	11	6	12	15	6	3	6	14	5	3	6
First Grade: Waterford Early Reading Program	46	26	20	0	28	17	11	0	18	9	9	0
Fourth Grade: Academy of Reading	41	27	5	9	22	15	3	4	19	12	2	5
Fourth Grade: LeapTrack	55	47	8	0	29	25	4	0	26	22	4	0
Sixth Grade: Achieve Now	39	19	18	2	21	12	8	1	18	7	10	1
Sixth Grade: Larson Pre-Algebra	39	21	17	1	24	14	10	0	15	7	7	1
Algebra I: Cognitive Tutor	29	11	12	6	15	6	8	1	14	5	4	5
Algebra I: Larson Algebra	43	26	12	5	24	15	6	3	19	11	6	2

Table B.2. Sample of Students, by Product

	Number of Students Participating								
	All			Treatment			Control		
	Total	Year 1	Year 2	Total	Year 1	Year 2	Total	Year 1	Year 2
Total	11,351	8,071	3,280	6,423	4,663	1,760	4,928	3,408	1,520
First Grade: Destination Reading	742	289	453	448	179	269	294	110	184
First Grade: Headsprout	1,079	811	268	574	429	145	505	382	123
First Grade: Plato Focus	618	299	319	327	168	159	291	131	160
First Grade: Waterford Early Reading Program	1,155	824	331	689	508	181	466	316	150
Fourth Grade: Academy of Reading	899	617	282	495	359	136	404	258	146
Fourth Grade: LeapTrack	1,274	1,093	181	665	569	96	609	524	85
Sixth Grade: Achieve Now	1,037	724	313	547	402	145	490	322	168
Sixth Grade: Larson Pre-Algebra	2,588	2,202	386	1,590	1,368	222	998	834	164
Algebra I: Cognitive Tutor	755	479	276	440	295	145	315	184	131
Algebra I: Larson Algebra I	1,204	733	471	648	386	262	556	347	209

Table B.3a. First Grade, Descriptive Statistics (means with standard deviations in parentheses)

	First Grade—All Products			First Grade—Destination Reading			First Grade—Headsprout			First Grade—Plato Focus			First Grade—Waterford Reading		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
<b>Student</b>															
Student is female	49.08 (50.00)	48.87 (50.00)	49.36 (50.01)	48.38 (50.01)	47.54 (50.00)	49.66 (50.08)	48.47 (50.00)	48.43 (50.02)	48.51 (50.03)	52.43 (49.98)	52.6 (50.01)	52.23 (50.04)	48.31 (49.99)	48.33 (50.01)	48.28 (50.02)
Student's age	6.64 (0.41)	6.63 (0.39)	6.65 (0.42)	6.68 (0.4)	6.68 (0.41)	6.67 (0.39)	6.67 (0.45)	6.64 (0.41)	6.69 (0.49)	6.63 (0.38)	6.61 (0.36)	6.66 (0.39)	6.60 (0.37)	6.60 (0.37)	6.59 (0.37)
Fall test total NCE	50.99 (20.53)	50.67 (20.9)	51.39 (20.03)	46.22 (18.66)	46.82 (19.18)	45.31 (17.84)	58.15 (20.47)	56.99 (20.85)	59.47 (19.96)	44.46 (20.13)	44.44 (20.66)	44.48 (19.56)	50.85 (19.87)	50.88 (20.7)	50.8 (18.59)
Spring test total NCE	51.87 (19.11)	51.78 (19.36)	51.98 (18.78)	50.15 (17.94)	50.82 (17.88)	49.13 (18.01)	56.11 (20.10)	55.24 (20.63)	57.10 (19.45)	50.8 (18.38)	51.15 (18.74)	50.40 (17.98)	49.58 (18.66)	49.83 (19.16)	49.21 (17.92)
<b>Sample Size</b>	<b>3,594</b>	<b>2,038</b>	<b>1,556</b>	<b>742</b>	<b>448</b>	<b>294</b>	<b>1,079</b>	<b>574</b>	<b>505</b>	<b>618</b>	<b>327</b>	<b>291</b>	<b>1,155</b>	<b>689</b>	<b>466</b>
<b>Teacher</b>															
Teacher is female	0.99 (0.08)	0.99 (0.10)	1.00 (0.00)	0.97 (0.17)	0.95 (0.22)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Teaching experience	12.86 (9.74)	12.89 (9.79)	12.81 (9.74)	16.21 (11.14)	17.59 (10.24)	14.14 (12.47)	10.52 (8.04)	9.56 (8.04)	11.51 (8.05)	16.57 (10.29)	16.02 (11.83)	17.17 (8.74)	11.17 (9.26)	11.51 (8.67)	10.62 (10.34)
Teacher has a master's degree	48.36 (49.70)	42.19 (49.38)	56.06 (49.33)	42.86 (48.72)	35.71 (47.81)	53.57 (49.86)	58.20 (49.36)	50.00 (50.8)	66.67 (47.14)	55.17 (50.61)	46.67 (51.64)	64.29 (49.72)	34.78 (48.15)	35.71 (48.80)	33.33 (48.51)
<b>Sample Size</b>	<b>173</b>	<b>96</b>	<b>77</b>	<b>35</b>	<b>21</b>	<b>14</b>	<b>63</b>	<b>32</b>	<b>31</b>	<b>29</b>	<b>15</b>	<b>14</b>	<b>46</b>	<b>28</b>	<b>18</b>
<b>School</b>															
Percentage scoring below fall test 33rd percentile	33.29 (18.80)			34.71 (19.84)			22.73 (19.1)			49.92 (16.36)			31.47 (11.99)		
Percentage scoring below spring test 33rd percentile	29.16 (13.17)			28.26 (17.3)			23.47 (13.98)			31.30 (10.92)			33.93 (7.18)		
Percentage receiving	50.29			71.06			34.46			47.64			47.35		

Table B.3a (continued)

	First Grade—All Products			First Grade—Destination Reading			First Grade—Headsprout			First Grade—Plato Focus			First Grade—Waterford Reading		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
free/reduced-price lunch	(27.79)			(14.48)			(21.99)			(19.92)			(35.62)		
Student/teacher ratio	16.2			18.95			14.53			15.79			15.44		
	(2.75)			(2.75)			(1.40)			(2.24)			(2.25)		
Percentage of Hispanic students	20.07			34.35			5.83			27.29			15.60		
	(20.32)			(25.26)			(9.28)			(12.78)			(17.10)		
Percentage of black students	23.49			31.49			13.47			5.32			36.55		
	(26.58)			(18.67)			(12.96)			(3.75)			(39.25)		
Urban	53.33			83.33			50.00			75.00			15.38		
	(50.45)			(38.92)			(52.22)			(46.29)			(37.55)		
<b>Sample Size</b>	<b>45</b>			<b>12</b>			<b>12</b>			<b>8</b>			<b>13</b>		

**Table B.3b. Fourth Grade, Descriptive Statistics (means with standard deviations in parentheses)**

	Fourth Grade—Total			Fourth Grade—Academy of Reading			Fourth Grade—LeapTrack		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
<b>Student</b>									
Student is female	49.95 (50.01)	47.99 (49.98)	52.16 (49.98)	49.72 (50.03)	47.68 (50.00)	52.23 (50.01)	50.55 (50.02)	48.87 (50.02)	52.38 (49.98)
Student's age	9.74 (0.60)	9.75 (0.63)	9.72 (0.57)	9.74 (0.55)	9.74 (0.56)	9.75 (0.53)	9.72 (0.64)	9.74 (0.68)	9.70 (0.59)
Fall test total NCE	42.65 (18.58)	41.65 (19.15)	43.78 (17.88)	41.20 (17.65)	39.42 (17.59)	43.38 (17.51)	43.68 (19.07)	43.66 (19.94)	43.71 (18.09)
Spring test total NCE	44.01 (19.87)	43.76 (20.62)	44.29 (19.01)	39.90 (18.18)	38.63 (18.31)	41.45 (17.92)	45.62 (21.26)	45.31 (21.70)	45.95 (20.78)
<b>Sample Size</b>	<b>2,173</b>	<b>1,160</b>	<b>1,013</b>	<b>899</b>	<b>495</b>	<b>404</b>	<b>1,274</b>	<b>665</b>	<b>609</b>
<b>Teacher</b>									
Teacher is female	84.38 (36.50)	80.39 (40.10)	88.89 (31.78)	80.49 (40.12)	72.73 (45.58)	89.47 (31.53)	87.27 (33.63)	86.21 (35.09)	88.46 (32.58)
Teaching experience	10.44 (9.17)	9.33 (8.17)	11.70 (10.14)	9.28 (8.03)	7.04 (5.09)	11.87 (9.99)	11.31 (9.93)	11.07 (9.62)	11.58 (10.44)
Teacher has a master's degree	33.33 (47.39)	29.41 (46.02)	37.78 (49.03)	31.71 (47.11)	27.27 (45.58)	36.84 (49.56)	34.55 (47.99)	31.03 (47.08)	38.46 (49.61)
<b>Sample Size</b>	<b>96</b>	<b>51</b>	<b>45</b>	<b>41</b>	<b>22</b>	<b>19</b>	<b>55</b>	<b>29</b>	<b>26</b>
<b>School</b>									
Percentage scoring below fall test 33rd percentile	51.68 (23.03)			53.38 (24.45)			50.11 (21.76)		
Percentage scoring below spring test 33rd percentile	51.81 (26.22)			58.41 (25.43)			46.28 (25.55)		
Percentage receiving free/reduced-price lunch	62.66 (22.24)			64.49 (20.49)			61.22 (23.98)		
Student/teacher ratio	16.58 (2.54)			15.48 (1.56)			17.44 (2.86)		
Percentage of Hispanic students	18.44 (24.30)			28.76 (25.57)			10.30 (20.39)		
Percentage of black students	55.86 (39.15)			54.42 (31.45)			57.00 (45.14)		
Urban	52.94 (50.66)			53.33 (51.64)			52.63 (51.30)		
<b>Sample Size</b>	<b>34</b>			<b>15</b>			<b>19</b>		

**Table B.3c. Sixth Grade, Descriptive Statistics (means with standard deviations in parentheses)**

	Sixth Grade—Total			Sixth Grade—Achieve Now			Sixth Grade—Larson Pre-Algebra		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
<b>Student</b>									
Student is female	51.60 (49.98)	51.54 (49.99)	51.68 (49.99)	53.52 (49.90)	52.29 (49.99)	54.90 (49.81)	50.81 (50.00)	51.45 (49.99)	50.10 (50.02)
Student's age	11.63 (0.52)	11.61 (0.50)	11.66 (0.55)	11.66 (0.56)	11.64 (0.55)	11.69 (0.56)	11.62 (0.51)	11.60 (0.48)	11.65 (0.54)
Fall test total NCE	50.29 (20.90)	49.53 (20.35)	51.37 (21.61)	45.16 (17.42)	43.40 (17.07)	47.13 (17.61)	52.39 (21.83)	50.82 (21.31)	53.45 (23.04)
Spring test total NCE	51.82 (20.30)	51.72 (20.15)	51.96 (20.51)	48.24 (19.02)	46.06 (18.44)	50.67 (19.38)	53.28 (20.63)	53.42 (20.30)	52.59 (21.03)
<b>Sample Size</b>	<b>3,625</b>	<b>2,137</b>	<b>1,488</b>	<b>1,037</b>	<b>547</b>	<b>490</b>	<b>2,588</b>	<b>1,590</b>	<b>998</b>
<b>Teacher</b>									
Teacher is female	67.95 (46.97)	62.22 (49.03)	75.76 (43.52)	79.49 (40.91)	80.95 (40.24)	77.78 (42.78)	56.41 (50.24)	45.83 (50.90)	73.33 (45.77)
Teaching experience	10.54 (9.22)	10.17 (8.79)	11.05 (9.90)	10.49 (9.19)	8.56 (8.53)	12.74 (9.65)	10.59 (9.38)	11.58 (8.96)	9.02 (10.14)
Teacher has a master's degree	32.05 (46.97)	28.89 (45.84)	36.36 (48.85)	33.33 (47.76)	23.81 (43.64)	44.44 (51.13)	30.77 (46.76)	33.33 (48.15)	26.67 (45.77)
<b>Sample Size</b>	<b>78</b>	<b>45</b>	<b>33</b>	<b>39</b>	<b>21</b>	<b>18</b>	<b>39</b>	<b>24</b>	<b>15</b>
<b>School</b>									
Percentage scoring below fall test 33rd percentile	37.35 (19.69)			40.18 (21.74)			34.51 (17.82)		
Percentage scoring below spring test 33rd percentile	32.86 (18.16)			34.93 (21.46)			30.78 (14.73)		
Percentage receiving free/reduced-price lunch	64.36 (22.03)			74.04 (14.21)			54.69 (24.63)		
Student/teacher ratio	17.28 (4.03)			14.82 (2.26)			19.75 (3.95)		
Percentage of Hispanic students	39.67 (36.49)			42.44 (35.85)			36.90 (38.38)		

Table B.3c (continued)

	Sixth Grade—Total			Sixth Grade—Achieve Now			Sixth Grade—Larson Pre-Algebra		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
Percentage of black students	27.94			40.19			15.69		
	(35.32)			(44.50)			(17.14)		
Urban	34.62			0.00			69.23		
	(48.52)			(0.00)			(48.04)		
Sample Size	26			13			13		

**Table B.3d. Algebra I, Descriptive Statistics (means with standard deviations in parentheses)**

	Total			Cognitive Tutor			Larson Algebra I		
	All	Treatment	Control	All	Treatment	Control	All	Treatment	Control
<b>Student</b>									
Student is female	49.90 (50.01)	51.32 (50.01)	48.14 (49.99)	48.87 (50.02)	51.14 (50.04)	45.71 (49.90)	50.83 (50.01)	51.85 (50.00)	49.64 (50.04)
Student's age	14.85 (1.03)	14.83 (0.98)	14.87 (1.08)	14.93 (0.97)	14.93 (0.89)	14.93 (1.07)	14.84 (1.08)	14.82 (1.07)	14.86 (1.09)
Fall test (percent correct)	32.22 (11.82)	31.96 (11.83)	32.55 (11.81)	28.26 (10.35)	27.67 (9.81)	29.07 (11.02)	34.83 (11.95)	35.04 (12.09)	34.58 (11.79)
Spring test (percent correct)	35.71 (13.30)	35.28 (13.23)	36.25 (13.36)	31.47 (11.60)	30.55 (10.54)	32.76 (12.86)	38.51 (13.56)	38.64 (13.84)	38.37 (13.23)
<b>Sample Size</b>	<b>1,959</b>	<b>1,088</b>	<b>871</b>	<b>755</b>	<b>440</b>	<b>315</b>	<b>1,204</b>	<b>648</b>	<b>556</b>
<b>Teacher</b>									
Teacher is female	62.50 (48.75)	56.41 (50.04)	69.70 (46.67)	58.62 (50.12)	60.00 (50.71)	57.14 (51.36)	65.12 (48.22)	54.17 (50.90)	78.95 (41.89)
Teaching experience	11.21 (9.50)	11.48 (9.09)	10.90 (10.10)	12.77 (8.66)	14.18 (7.88)	11.25 (9.48)	10.17 (9.99)	9.80 (9.54)	10.64 (10.78)
Teacher has a master's degree	54.17 (50.18)	53.85 (50.50)	54.55 (50.57)	41.38 (50.12)	40.00 (50.71)	42.86 (51.36)	62.79 (48.91)	62.50 (49.45)	63.16 (49.56)
<b>Sample Size</b>	<b>72</b>	<b>39</b>	<b>33</b>	<b>29</b>	<b>15</b>	<b>14</b>	<b>43</b>	<b>24</b>	<b>19</b>
<b>School</b>									
Percentage receiving free/reduced-price	52.34 (25.79)			63.17 (18.12)			42.42 (28.40)		
Student/teacher ratio	16.20 (3.60)			15.08 (4.65)			17.22 (1.99)		
Percentage of Hispanic students	14.53 (22.31)			20.54 (26.47)			9.02 (17.01)		
Percentage of black students	44.64 (34.83)			53.69 (29.63)			36.35 (38.35)		
Urban	47.83 (51.08)			63.64 (50.45)			33.33 (49.24)		
<b>Sample Size</b>	<b>23</b>			<b>11</b>			<b>12</b>		



## Appendix C

### Details of Estimation Methods

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The first part of the study tests whether teachers' experience using software products for a second year had larger effects on student test scores than in the first year. The question is addressed by restricting the sample of teachers to those that participated in both years of the study. The method used for estimating product effects on student test scores is a two-level hierarchical linear model with students nested within teachers and student and teacher characteristics as predictors of student test scores. The models allow for product effects on student achievement to differ in the first year and in the second year, supporting a test of the hypothesis that teacher experience is related to product effects.

A two-level model is used to estimate experience effects. The model's key component is an interaction between the treatment indicator and a year indicator, as shown in the following equations:

$$(C.1 \text{ Student}) \quad Y_{ij} = \alpha_{0j} + \alpha_{1j}Y2_{ij} + \pi X_{ij} + \varepsilon_{ij}$$

$$(C.2 \text{ Teachers}) \quad \begin{aligned} \alpha_{0j} &= \beta_{00} + \beta_{01}T_j + \phi W_j + \mu_{0j} \\ \alpha_{1j} &= \beta_{10} + \beta_{11}T_j \end{aligned}$$

where the dependent variable Y is the student spring test score. The predictors in the first-level equation (the X variables) are student age, gender, and fall test score<sup>29</sup>, and Y2, which is an indicator variable of whether the student participated in the second year of the study. (which is 1 if the student was in the second year and 0 if the student was in the first year). The predictors in the second-level equation are T, an indicator variable of whether the teacher is in the treatment or control group, and W, which are teacher characteristics (years of teaching experience, whether the teacher has a master's degree). Schools are modeled as second-level fixed effects (for each school, the model includes an indicator variable equal to 1 for teachers belonging to a school and 0 for teachers not belonging to the school).

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<sup>29</sup>District test scores were used for some students in the second year and the models also include an indicator variable for whether students have a district test score instead of the study administered test score, which is interacted with the fall test score (for example, interaction variables such as ITBS\*fall test score or CAT6\*fall test score in Tables C.1, C.2, and C.3).

Combining the equations and collecting terms yields a mixed-model estimating equation in which the product effect is related to student and teachers characteristics:

(C.3 *Mixed model with interactions*)

$$Y_{ij} = \beta_{00} + \beta_{01}T_j + \beta_{10}Y2_{ij} + \beta_{11}T_j * Y2_{ij} + \pi X_{ij} + \phi W_j + \xi_{ij}$$

and the error term has the structure:

$$\xi_{ij} = \mu_{0j} + \varepsilon_{ij}.$$

To simplify the presentation, equation C.3 does not include terms for the school-level indicator variables and for the test interactions (discussed in footnote 30).

The treatment-effect estimator in (C.3) has two components,  $\beta_{01}$  and  $\beta_{11}$ . The first is the product effect in the first year of the study,  $\beta_{01}$ , the coefficient of the treatment indicator. The second is the difference of the product effect between the first year and the second year,  $\beta_{11}$ , the coefficient of the interaction of the treatment indicator with the year indicator. The total product effect in the second year is  $\beta_{01} + \beta_{11}$ . Statistically significant estimates of  $\beta_{11}$  are evidence of differences in product effects between the first and second years.

Table C.1 shows complete estimation results and the variables used in the models, (except for coefficients of school indicator variables). Positive coefficients indicate a variable is correlated with an increase in the spring test score and negative coefficients indicate a variable is correlated with a decrease. The units of the coefficient are the same as the units of the test scores, which is normal curve equivalents for first, fourth, and sixth grades, and percent correct for algebra I. The table also shows residual variances at the student and teacher levels, at the bottom of the table.

Treatment effects on year 1 spring test scores reported in the text refer to the estimated coefficients of the “treatment classroom” indicator variable at the teacher level. For example, the treatment effect on first grade spring scores in year 1 shown in Table C.1 as 0.86 corresponds to the estimated coefficient of the treatment classroom indicator. The  $p$ -value shown in Table II.3 in the main text above is the  $p$ -value of the estimated treatment coefficient.

The treatment effects on year 2 spring scores reported in the text are the sum of the estimated coefficients of the “treatment classroom” indicator variable at the teacher level and the “Year 2 \* Treatment (interaction)” estimate. For example, the second-year treatment effect of  $-1.28$  reported in Table II.3 corresponds to the sum of 0.86, the estimated treatment effect of year 1, and  $-2.14$ , the interaction of year 2 with the treatment indicator, which is the amount by which the first-year effect is shifted to become the second-year effect. Finally, the difference in effects reported in Table II.3 of  $-2.14$  corresponds to

the interaction of year 2 with the treatment indicator, which is what we interpret as the experience effect using software products for a second year on student test scores.

### **Models for Individual Product Effects**

The model used to estimate individual product effects is similar to the model presented above. The difference is that product effects are constrained to be equal in both years, which is done by setting  $\beta_{11} = 0$ . The constraint forces the treatment effect to have one component,  $\beta_{01}$ .

Table C.2 presents estimates of individual product effects based on teachers, students, and schools that participated in the study either in the first or in the second year. The effects are referred to as product effects for the full sample because they are based on samples that include teachers who participated in the study either in one year of the study (first or second) and teachers who participated in both years. Table C.3 presents product effects using only the sample of teachers, students, and schools that participated in the second year of the study. In the tables, the estimated coefficients for the variable “treatment classroom” are the treatment effects of interest.

**Table C.1. Product Effects in Year 2 Compared to Product Effects in Year 1 Hierarchical Linear Model Estimates: Outcome Is Spring Test Score (standard errors in parentheses)**

Variable Name	First Grade	Fourth Grade	Sixth Grade	Algebra I
<b>Student Level</b>				
Intercept	49.11*** (1.22)	50.31*** (1.07)	52.96*** (1.24)	35.34*** (0.82)
Student age	-3.44*** (0.83)	-3.82*** (1.08)		
Student is female	1.37** (0.61)	1.37 (0.95)	0.46 (0.49)	-1.70** (0.71)
Fall test score	0.70*** (0.01)	0.74*** (0.02)	0.72*** (0.01)	0.36*** (0.03)
Year 2	3.61*** (0.97)	-1.30 (1.55)	-1.39 (0.90)	-1.16 (1.08)
ITBS*Fall test score	-0.03 (0.04)	0.02 (0.04)	0.03 (0.04)	-0.13 (0.10)
NMSBA*Fall test score			0.12*** (0.03)	
SAT10*Fall test score	0.01 (0.03)			
CAT6*Fall test score		0.31*** (0.06)		
<b>Classroom Level</b>				
Treatment classroom	0.86 (1.67)	2.65 (1.54)	-0.44 (1.87)	-0.34 (1.13)
Year 2* treatment classroom	-2.14* (1.22)	2.02 (1.89)	-2.80** (1.14)	2.90** (1.44)
Teacher has a master's degree	-3.75 (2.33)	2.78 (2.08)	-3.26 (2.82)	-0.07 (1.21)
Years of teaching experience	-0.06 (0.13)	0.19* (0.06)	0.03 (0.11)	-0.02 (0.05)
<b>Residual Variance</b>				
Student level	125.74	129.47	138.60	125.75
Classroom level	17.67***	0.03	16.86***	0.27

Note: School indicators were also included as covariates in the models but are not presented in the tables.

\*Statistically significant at the .10 level, two-tailed test.

\*\*Statistically significant at the .05 level, two-tailed test.

\*\*\*Statistically significant at the .01 level, two-tailed test.

**Table C.2**      **Product Effects for the Full Sample (First and Second Years)**  
**Hierarchical Linear Model Estimates: Outcome Is Spring Test Score**  
**(standard errors in parentheses)**

	First Grade				Fourth Grade		Sixth Grade		Algebra I	
	Destination Reading	Headsprout	Plato Focus	Waterford Early Reading Program	Academy of Reading	LeapTrack	Achieve Now	Larson Pre- Algebra	Cognitive Tutor	Larson Algebra I
<b>Student Level</b>										
Intercept	50.23*** (0.77)	55.97*** (0.52)	50.77*** (0.65)	49.11*** (0.67)	39.82*** (0.45)	45.54*** (0.39)	38.13 (23.35)	52.73*** (0.73)	32.19*** (0.53)	37.84*** (0.55)
Student is female	1.33 (0.8)	-0.47 (0.81)	0.26 (0.95)	1.48** (0.67)	1.67** (0.7)	0.79 (0.61)	0.11 (0.64)	0.12 (0.49)	-0.89 (0.72)	-0.55 (0.69)
Student age	-1.61 (1.01)	-3.33*** (0.84)	-5.46*** (1.39)	-2.45** (0.98)	-0.47 (0.69)	-2.73*** (0.52)	-0.49 (0.67)	-1.42*** (0.51)		
Fall test score	0.68*** (0.02)	0.77*** (0.02)	0.71*** (0.02)	0.74*** (0.01)	0.79*** (0.02)	0.74*** (0.01)	0.6 (0.36)	0.7*** (0.01)	0.28*** (0.03)	0.43*** (0.03)
ITBS*Fall test score				0.02 (0.03)	-0.04 (0.02)		-0.04 (0.04)			-0.17** (0.07)
SAT10*Fall test score	0.01 (0.02)									
CAT6*Fall test score						0.29*** (0.05)				
NMSBA*Fall test score							0.05 (0.03)			

Table C.2 (continued)

	First Grade				Fourth Grade		Sixth Grade		Algebra I	
	Destination Reading	Headsprout	Plato Focus	Waterford Early Reading Program	Academy of Reading	LeapTrack	Achieve Now	Larson Pre- Algebra	Cognitive Tutor	Larson Algebra I
<b>Classroom Level</b>										
Treatment classroom	1.91 (1.67)	0.29 (1.09)	0.50 (1.39)	0.42 (1.41)	-0.16 (1.01)	1.97** (0.73)	-0.58 (1.45)	2.37 (1.56)	-1.28 (1.1)	-0.1 (1.08)
Teacher has a master's degree	-1.05 (2.09)	0.15 (1.33)	-0.42 (1.95)	-2.02 (1.65)	-0.14 (1.31)	1.52 (1.01)	-1.60 (2.26)	1.23 (1.96)	0.96 (1.75)	0.77 (1.54)
Years of teaching experience	-0.28** (0.12)	-0.05 (0.07)	0.07 (0.09)	-0.05 (0.11)	0.03 (0.09)	0.10** (0.04)	0.08 (0.1)	0.02 (0.12)	-0.08 (0.1)	0.10 (0.07)
<b>Residual Variance</b>										
Student level	113.64	143.27	129.75	124.25	103.28	111.58	97.51	147.64	92.81	135.26
Classroom level	15.11	8.32	5.92	15.21	3.24	1.81	11.81	17.64	3.45	5.34

Note: School indicators were also included as covariates in the models but are not presented in the tables.

\*Statistically significant at the .10 level, two-tailed test.

\*\*Statistically significant at the .05 level, two-tailed test.

\*\*\*Statistically significant at the .01 level, two-tailed test.

**Table C.3 Product Effects for the Second-Year Sample**  
**Hierarchical Linear Model Estimates: Outcome Is Spring Test Score**  
 (standard errors in parentheses)

Variable Name	First Grade			
	Destination Reading	Headsprout	Plato Focus	Waterford Early Reading
<b>Student Level</b>				
Intercept	53.84*** (1.00)	57.42*** (0.85)	52.51*** (0.71)	51.20*** (1.02)
Student is female	1.65* (0.91)	1.10 (1.33)	-0.21 (1.22)	1.40 (1.16)
Student age	-0.65 (1.27)	-4.73*** (1.53)	-6.6*** (1.72)	-2.52 (1.67)
Fall test score	0.62*** (0.06)	0.64*** (0.04)	0.62*** (0.03)	0.66*** (0.03)
ITBS*Fall test score				-0.09 (0.08)
SAT10*Fall test score	0.05 (0.07)			
<b>Classroom Level</b>				
Treatment classroom	2.19 (2.08)	-4.13* (1.92)	-0.10 (1.45)	-1.76 (2.02)
Teacher has a master's degree	-2.19 (2.76)	-3.97 (3.26)	-3.27 (2.21)	-4.13 (3.06)
Years of teaching experience	-0.32 (0.20)	-0.19 (0.13)	0.01 (0.09)	-0.24 (0.20)
<b>Residual Variance</b>				
Student level	88.68	115.16	105.67	104.18
Classroom level	19.87	4.26	2.98	11.11

Table C.3 (*continued*)

Variable Name	Fourth Grade		Sixth Grade		Algebra I	
	Academy of Reading	LeapTrack	Achieve Now	Larson Pre- Algebra	Cognitive Tutor	Larson Algebra I
<b>Student Level</b>						
Intercept	46.21*** (1.16)	59.95*** (1.05)	47.54*** (1.65)	51.41*** (1.22)	31.88*** (0.93)	40.19*** (0.67)
Student is female	2.00 (1.34)	2.27 (1.92)	0.53 (1.36)	0.32 (1.32)	0.39 (1.23)	-2.24* (1.21)
Student age	-0.90 (1.61)	-7.08*** (2.55)	-0.73 (1.45)	-1.61 (1.43)		
Fall test score	0.86*** (0.06)	0.63*** (0.06)	0.77*** (0.08)	0.68*** (0.04)	0.34*** (0.06)	0.53*** (0.05)
ITBS*Fall test score	-0.08 (0.08)		0.06 (0.12)			-0.14 (0.21)
SAT10*Fall test score						
CAT6*Fall test score		0.19 (0.13)				
NMSBA*Fall test score			0.01 (0.10)			
<b>Classroom Level</b>						
Treatment classroom	1.86 (2.78)	2.88 (1.94)	-1.59 (4.32)	-0.44 (2.53)	-2.10 (1.87)	2.59 (1.57)
Teacher has a master's degree	1.74 (3.74)		-6.32 (4.69)	-3.51 (6.75)	4.56 (2.62)	-0.41 (2.70)
Years of teaching experience	0.10 (0.23)		0.19 (0.26)	0.16 (0.21)	-0.03*** (0.18)	0.07 (0.08)
<b>Residual Variance</b>						
Student level	121.61	157.01	132.60	154.06	98.37	147.31
Classroom level	12.82	0.19	43.59	18.99	7.90	0.39

Note: School indicators were also included as covariates in the models but are not presented in the tables.

\*Statistically significant at the .10 level, two-tailed test.

\*\*Statistically significant at the .05 level, two-tailed test.

\*\*\*Statistically significant at the .01 level, two-tailed test.